PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB2005/000360	03.02.2005	16.02.2004

International Patent Classification (IPC) or both national classification and IPC
G01V3/12

Applicant
OHM LIMITED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:

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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ in written format

   ☐ in computer readable form

   c. time of filing/furnishing:

   ☐ contained in the international application as filed.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-50
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-50
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-50
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following document:

D1: ELLINGSRUD S ET AL: "Remote sensing of hydrocarbon layers by seabed logging (SBL): Results from a cruise offshore Angola" LEADING EDGE; LEADING EDGE (TULSA, OK) OCTOBER 2002, vol. 21, no. 10, October 2002 (2002-10), pages 972-982, XP002328147

2. The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses a method of analysing results from an electromagnetic survey of an area that is thought or known to contain a subterranean resistive or conductive body comprising the following step :
-providing electric field data and magnetic field data obtained by at least one receiver from at least one horizontal electric dipole (HED) transmitter.

The subject-matter of claim 1 differs from this known document in that a vertical gradient in the electrical field data is determined and in that the vertical gradient in the electrical field data is combined with the magnetic field data to generate combined response data.
The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

3. The problem to be solved by the present invention may be regarded as a desire to conduct an electromagnetic survey in shallow waters with simple tow patterns.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons.
The electromagnetic (EM) signals comprise transverse electric (TE) and transverse magnetic (TM) mode components. In shallow water surveys, the airwave component, principally due to the TE mode components, tends to dominate the EM fields induced by the horizontal electric dipole transmitter (HED) at the receiver, especially at long transmitter-receiver horizontal separations. This airwave component contains little

information about subterranean resistivity. Accordingly, if the airwave contributes a significant component to the EM fields induced by the HED transmitter at the receiver, the sensitivity of the technique to subterranean resistivity structures is greatly reduced. Combining the vertical gradient in the electric field data and the magnetic field data allows one to significantly reduce the TE mode component and therefore to detect hydrocarbon reservoirs in shallow water. Furthermore, since there is no mixing between the TE and TM modes in the combined response data, data from all possible transmitter and receiver orientations may be used.
None of the documents cited in the search report disclose or suggest combining the vertical gradient in the electric field data and the magnetic field data to suppress the airwave component.

4. Independent method claims 30 and 37 are alternative solutions in combining the vertical gradient in the electric field data with the magnetic field data to attenuate the airwave component, Therefore they are new and involves an inventive step (Article 33(2)(3) PCT).

For the same reasons the corresponding computer programs, apparatus, EM receiver and EM source for use claims 28,29,35,46,50 for performing methods of claims 1,30,37 are new and involves an inventive step (Article 33(2)(3) PCT).